

Supplementary Information

Supplement 1. The Complete Search strategies

The literature search cutoff date was set as October 9, 2024.

A further exclusion process was conducted in EndNote X9 on the records retrieved from PubMed, the Cochrane Library, and Web of Science. Review articles, study protocols, case reports, editorials, and clinical guidelines were removed, and only English-language publications were retained.

1. Search strategy for PubMed:

(1) PD (Parkinson Disease):

#1 "parkinson disease"[MeSH Terms] OR ("parkinson"[All Fields] AND "disease"[All Fields]) OR "parkinson disease"[All Fields] OR ("parkinson disease"[MeSH Terms] OR ("parkinson"[All Fields] AND "disease"[All Fields]) OR "parkinson disease"[All Fields] OR ("idiopathic"[All Fields] AND "parkinson s"[All Fields] AND "disease"[All Fields]) OR "idiopathic parkinson s disease"[All Fields]) OR ("parkinson disease"[MeSH Terms] OR ("parkinson"[All Fields] AND "disease"[All Fields]) OR "parkinson disease"[All Fields] OR ("lewy"[All Fields] AND "body"[All Fields] AND "parkinson s"[All Fields] AND "disease"[All Fields]) OR "lewy body parkinson s disease"[All Fields]) OR ("parkinson disease"[MeSH Terms] OR ("parkinson"[All Fields] AND "disease"[All Fields]) OR "parkinson disease"[All Fields] OR ("parkinson s"[All Fields] AND "disease"[All Fields] AND "idiopathic"[All Fields]) OR "parkinson s disease idiopathic"[All Fields]) OR ("parkinson disease"[MeSH Terms] OR ("parkinson"[All Fields] AND "disease"[All Fields]) OR "parkinson disease"[All Fields] OR ("parkinson s"[All Fields] AND "disease"[All Fields] AND "lewy"[All Fields] AND "body"[All Fields]) OR "parkinson s disease lewy body"[All Fields]) OR ("parkinson disease"[MeSH Terms] OR ("parkinson"[All Fields] AND "disease"[All Fields]) OR "parkinson disease"[All Fields] OR ("parkinson"[All Fields] AND "disease"[All Fields] AND "idiopathic"[All Fields]) OR "parkinson disease idiopathic"[All Fields]) OR ("parkinson disease"[MeSH Terms] OR ("parkinson"[All Fields] AND "disease"[All Fields]) OR "parkinson disease"[All Fields] OR ("parkinson s"[All Fields] AND "disease"[All Fields]) OR "parkinson s disease"[All Fields]) OR ("parkinson disease"[MeSH Terms] OR ("parkinson"[All Fields] AND "disease"[All Fields]) OR "parkinson disease"[All Fields] OR ("idiopathic"[All Fields] AND "parkinson"[All

- Fields] AND "disease"[All Fields]) OR "idiopathic parkinson disease"[All Fields]) OR ("parkinson disease"[MeSH Terms] OR ("parkinson"[All Fields] AND "disease"[All Fields]) OR "parkinson disease"[All Fields] OR ("lewy"[All Fields] AND "body"[All Fields] AND "parkinson"[All Fields] AND "disease"[All Fields]) OR "lewy body parkinson disease"[All Fields]) OR ("parkinson disease"[MeSH Terms] OR ("parkinson"[All Fields] AND "disease"[All Fields]) OR "parkinson disease"[All Fields] OR ("primary"[All Fields] AND "parkinsonism"[All Fields]) OR "primary parkinsonism"[All Fields]) OR ("parkinson disease"[MeSH Terms] OR ("parkinson"[All Fields] AND "disease"[All Fields]) OR "parkinson disease"[All Fields] OR ("parkinsonism"[All Fields] AND "primary"[All Fields]) OR "parkinsonism primary"[All Fields]) OR ("parkinson disease"[MeSH Terms] OR ("parkinson"[All Fields] AND "disease"[All Fields]) OR "parkinson disease"[All Fields] OR ("paralysis"[All Fields] AND "agitans"[All Fields]) OR "paralysis agitans"[All Fields])
- #2 "rehabilitant"[All Fields] OR "rehabilitants"[All Fields] OR "rehabilitate"[All Fields] OR "rehabilitated"[All Fields] OR "rehabilitates"[All Fields] OR "rehabilitating"[All Fields] OR "rehabilitation"[MeSH Terms] OR "rehabilitation"[All Fields] OR "rehabilitations"[All Fields] OR "rehabilitative"[All Fields] OR "rehabilitation"[MeSH Subheading] OR "rehabilitation s"[All Fields] OR "rehabilitational"[All Fields] OR "rehabilitator"[All Fields] OR "rehabilitators"[All Fields] OR "habilitate"[All Fields] OR "habilitated"[All Fields] OR "habilitating"[All Fields] OR "habilitations"[All Fields] OR "habilitative"[All Fields] OR "rehabilitation"[MeSH Terms] OR "rehabilitation"[All Fields] OR "habilitation"[All Fields]
- #3 "virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("reality"[All Fields] AND "virtual"[All Fields]) OR "reality virtual"[All Fields]) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("virtual"[All Fields] AND "reality"[All Fields] AND "educational"[All Fields]) OR "virtual reality educational"[All Fields]) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("educational"[All Fields] AND "virtual"[All Fields] AND "realities"[All Fields]) OR "educational virtual realities"[All Fields]) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("educational"[All Fields] AND "virtual"[All Fields] AND "reality"[All Fields]) OR

"educational virtual reality"[All Fields]) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("reality"[All Fields] AND "educational"[All Fields] AND "virtual"[All Fields])) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("virtual"[All Fields] AND "realities"[All Fields] AND "educational"[All Fields])) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("virtual"[All Fields] AND "realities"[All Fields] AND "instructional"[All Fields]) OR "virtual reality instructional"[All Fields]) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("instructional"[All Fields] AND "virtual"[All Fields] AND "realities"[All Fields])) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("instructional"[All Fields] AND "virtual"[All Fields] AND "realities"[All Fields])) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("instructional"[All Fields] AND "virtual"[All Fields] AND "realities"[All Fields] AND "instructional"[All Fields] AND "virtual"[All Fields])) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("reality"[All Fields] AND "instructional"[All Fields] AND "virtual"[All Fields])) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("virtual"[All Fields] AND "realities"[All Fields] AND "instructional"[All Fields]))

(2) MS (Multiple sclerosis):

Fields] AND "sclerosis"[All Fields]) OR "multiple sclerosis"[All Fields] OR ("disseminated"[All Fields] AND "sclerosis"[All Fields]) OR "disseminated sclerosis"[All Fields]) OR ("multiple sclerosis"[MeSH Terms] OR ("multiple"[All Fields] AND "sclerosis"[All Fields]) OR "multiple sclerosis"[All Fields] OR ("multiple"[All Fields] AND "sclerosis"[All Fields] AND "acute"[All Fields] AND "fulminating"[All Fields]) OR "multiple sclerosis acute fulminating"[All Fields])

AND "reality"[All Fields] AND "instructional"[All Fields]) OR "virtual reality instructional"[All Fields]) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("instructional"[All Fields] AND "virtual"[All Fields] AND "realities"[All Fields])) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("instructional"[All Fields] AND "virtual"[All Fields] AND "reality"[All Fields])) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("realities"[All Fields] AND "instructional"[All Fields] AND "virtual"[All Fields])) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("reality"[All Fields] AND "instructional"[All Fields] AND "virtual"[All Fields])) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("virtual"[All Fields] AND "realities"[All Fields] AND "instructional"[All Fields]))

#4 #1 AND #2 AND #3 151(Search results)

(3) CI (Cognitive Dysfunction):

#1 "cognitive dysfunction"[MeSH Terms] OR ("cognitive"[All Fields] AND "dysfunction"[All Fields]) OR "cognitive dysfunction"[All Fields] OR ("cognitive dysfunction"[MeSH Terms] OR ("cognitive"[All Fields] AND "dysfunction"[All Fields]) OR "cognitive dysfunction"[All Fields] OR ("cognitive"[All Fields] AND "dysfunctions"[All Fields]) OR "cognitive dysfunctions"[All Fields]) OR ("cognitive dysfunction"[MeSH Terms] OR ("cognitive"[All Fields] AND "dysfunction"[All Fields]) OR "cognitive dysfunction"[All Fields] OR ("dysfunction"[All Fields] AND "cognitive"[All Fields]) OR "dysfunction cognitive"[All Fields]) OR ("cognitive dysfunction"[MeSH Terms] OR ("cognitive"[All Fields] AND "dysfunction"[All Fields]) OR "cognitive dysfunction"[All Fields] OR ("dysfunctions"[All Fields] AND "cognitive"[All Fields]) OR "dysfunctions cognitive"[All Fields]) OR ("cognitive dysfunction"[MeSH Terms] OR ("cognitive"[All Fields] AND "dysfunction"[All Fields]) OR "cognitive dysfunction"[All Fields] OR ("cognitive"[All Fields] AND "disorder"[All Fields]) OR "cognitive disorder"[All Fields]) OR ("cognitive dysfunction"[MeSH Terms] OR ("cognitive"[All Fields] AND "dysfunction"[All Fields]) OR "cognitive dysfunction"[All Fields] OR ("cognitive"[All Fields] AND "disorders"[All Fields]) OR "cognitive disorders"[All Fields]) OR ("cognitive dysfunction"[MeSH Terms] OR

("cognitive"[All Fields] AND "dysfunction"[All Fields]) OR "cognitive
 dysfunction"[All Fields] OR ("disorder"[All Fields] AND "cognitive"[All Fields]) OR
 "disorder cognitive"[All Fields]) OR ("cognitive dysfunction"[MeSH Terms] OR
 ("cognitive"[All Fields] AND "dysfunction"[All Fields]) OR "cognitive
 dysfunction"[All Fields] OR ("disorders"[All Fields] AND "cognitive"[All Fields]) OR
 "disorders cognitive"[All Fields]) OR ("cognitive dysfunction"[MeSH Terms] OR
 ("cognitive"[All Fields] AND "dysfunction"[All Fields]) OR "cognitive
 dysfunction"[All Fields] OR ("cognitive"[All Fields] AND "impairments"[All Fields])
 OR "cognitive impairments"[All Fields]) OR ("cognitive dysfunction"[MeSH Terms]
 OR ("cognitive"[All Fields] AND "dysfunction"[All Fields]) OR "cognitive
 dysfunction"[All Fields] OR ("cognitive"[All Fields] AND "impairment"[All Fields])
 OR "cognitive impairment"[All Fields]) OR ("cognitive dysfunction"[MeSH Terms] OR
 ("cognitive"[All Fields] AND "dysfunction"[All Fields]) OR "cognitive
 dysfunction"[All Fields] OR ("impairment"[All Fields] AND "cognitive"[All Fields])
 OR "impairment cognitive"[All Fields]) OR ("cognitive dysfunction"[MeSH Terms] OR
 ("cognitive"[All Fields] AND "dysfunction"[All Fields]) OR "cognitive
 dysfunction"[All Fields] OR ("impairments"[All Fields] AND "cognitive"[All Fields])
 OR "impairments cognitive"[All Fields]) OR ("cognitive dysfunction"[MeSH Terms]
 OR ("cognitive"[All Fields] AND "dysfunction"[All Fields]) OR "cognitive
 dysfunction"[All Fields] OR ("mild"[All Fields] AND "cognitive"[All Fields] AND
 "impairment"[All Fields]) OR "mild cognitive impairment"[All Fields]) OR ("cognitive
 dysfunction"[MeSH Terms] OR ("cognitive"[All Fields] AND "dysfunction"[All Fields])
 OR "cognitive dysfunction"[All Fields] OR ("cognitive"[All Fields] AND
 "impairment"[All Fields] AND "mild"[All Fields]) OR "cognitive impairment mild"[All
 Fields]) OR ("cognitive dysfunction"[MeSH Terms] OR ("cognitive"[All Fields] AND
 "dysfunction"[All Fields]) OR "cognitive dysfunction"[All Fields] OR ("cognitive"[All
 Fields] AND "impairments"[All Fields] AND "mild"[All Fields]) OR "cognitive
 impairments mild"[All Fields]) OR ("cognitive dysfunction"[MeSH Terms] OR
 ("cognitive"[All Fields] AND "dysfunction"[All Fields]) OR "cognitive
 dysfunction"[All Fields] OR ("impairment"[All Fields] AND "mild"[All Fields] AND
 "cognitive"[All Fields]) OR "impairment mild cognitive"[All Fields]) OR ("cognitive
 dysfunction"[MeSH Terms] OR ("cognitive"[All Fields] AND "dysfunction"[All Fields])
 OR "cognitive dysfunction"[All Fields] OR ("impairments"[All Fields] AND "mild"[All
 Fields] AND "cognitive"[All Fields]) OR "impairments mild cognitive"[All Fields]) OR

("cognitive dysfunction"[MeSH Terms] OR ("cognitive"[All Fields] AND "dysfunction"[All Fields]) OR "cognitive dysfunction"[All Fields] OR ("mild"[All Fields] AND "cognitive"[All Fields] AND "impairments"[All Fields]) OR "mild cognitive impairments"[All Fields]) OR ("cognitive dysfunction"[MeSH Terms] OR ("cognitive"[All Fields] AND "dysfunction"[All Fields]) OR "cognitive dysfunction"[All Fields] OR ("cognitive"[All Fields] AND "decline"[All Fields]) OR "cognitive decline"[All Fields]) OR ("cognitive dysfunction"[MeSH Terms] OR ("cognitive"[All Fields] AND "dysfunction"[All Fields]) OR "cognitive dysfunction"[All Fields] OR ("cognitive"[All Fields] AND "declines"[All Fields]) OR "cognitive declines"[All Fields]) OR ("cognitive dysfunction"[MeSH Terms] OR ("cognitive"[All Fields] AND "dysfunction"[All Fields]) OR "cognitive dysfunction"[All Fields] OR ("decline"[All Fields] AND "cognitive"[All Fields]) OR "decline cognitive"[All Fields]) OR ("cognitive dysfunction"[MeSH Terms] OR ("cognitive"[All Fields] AND "dysfunction"[All Fields]) OR "cognitive dysfunction"[All Fields] OR ("declines"[All Fields] AND "cognitive"[All Fields]) OR "declines cognitive"[All Fields]) OR ("cognitive dysfunction"[MeSH Terms] OR ("cognitive"[All Fields] AND "dysfunction"[All Fields]) OR "cognitive dysfunction"[All Fields] OR ("mental"[All Fields] AND "deterioration"[All Fields]) OR "mental deterioration"[All Fields]) OR ("cognitive dysfunction"[MeSH Terms] OR ("cognitive"[All Fields] AND "dysfunction"[All Fields]) OR "cognitive dysfunction"[All Fields] OR ("deterioration"[All Fields] AND "mental"[All Fields]) OR "deterioration mental"[All Fields]) OR ("cognitive dysfunction"[MeSH Terms] OR ("cognitive"[All Fields] AND "dysfunction"[All Fields]) OR "cognitive dysfunction"[All Fields] OR ("deteriorations"[All Fields] AND "mental"[All Fields])) OR ("cognitive dysfunction"[MeSH Terms] OR ("cognitive"[All Fields] AND "dysfunction"[All Fields]) OR "cognitive dysfunction"[All Fields] OR ("mental"[All Fields] AND "deteriorations"[All Fields]) OR "mental deteriorations"[All Fields])

#2 "rehabilitant"[All Fields] OR "rehabilitants"[All Fields] OR "rehabilitate"[All Fields] OR "rehabilitated"[All Fields] OR "rehabilitates"[All Fields] OR "rehabilitating"[All Fields] OR "rehabilitation"[MeSH Terms] OR "rehabilitation"[All Fields] OR "rehabilitations"[All Fields] OR "rehabilitative"[All Fields] OR "rehabilitation"[MeSH Subheading] OR "rehabilitation s"[All Fields] OR "rehabilitational"[All Fields] OR "rehabilitator"[All Fields] OR "rehabilitators"[All Fields] OR "habilitate"[All Fields] OR "habilitated"[All Fields] OR "habilitating"[All Fields] OR "habilitations"[All Fields]

OR "habilitative"[All Fields] OR "rehabilitation"[MeSH Terms] OR "rehabilitation"[All Fields] OR "habilitation"[All Fields]

#3 "virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("reality"[All Fields] AND "virtual"[All Fields]) OR "reality virtual"[All Fields]) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("virtual"[All Fields] AND "reality"[All Fields] AND "educational"[All Fields]) OR "virtual reality educational"[All Fields]) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("educational"[All Fields] AND "virtual"[All Fields] AND "realities"[All Fields]) OR "educational virtual realities"[All Fields]) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("educational"[All Fields] AND "virtual"[All Fields] AND "reality"[All Fields]) OR "educational virtual reality"[All Fields]) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("reality"[All Fields] AND "educational"[All Fields] AND "virtual"[All Fields])) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("virtual"[All Fields] AND "realities"[All Fields] AND "educational"[All Fields])) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("virtual"[All Fields] AND "reality"[All Fields] AND "instructional"[All Fields]) OR "virtual reality instructional"[All Fields]) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("instructional"[All Fields] AND "virtual"[All Fields] AND "reality"[All Fields])) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("realities"[All Fields] AND "instructional"[All Fields] AND "virtual"[All Fields])) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("reality"[All Fields] AND "instructional"[All Fields] AND "virtual"[All Fields])) OR ("virtual reality"[MeSH Terms] OR ("virtual"[All Fields] AND "reality"[All Fields]) OR "virtual reality"[All Fields] OR ("virtual"[All Fields]

AND "realities"[All Fields] AND "instructional"[All Fields]))

#4 #1 AND #2 AND #3 648 (Search results)

2. Search strategy for Cochrane Library

(1) PD (Parkinson Disease):

#1 (Parkinson Disease) OR (Idiopathic Parkinson's Disease) OR (Lewy Body Parkinson's Disease) OR (Parkinson's Disease, Idiopathic) OR (Parkinson's Disease, Lewy Body) OR (Parkinson Disease, Idiopathic) OR (Parkinson's Disease) OR (Idiopathic Parkinson Disease) OR (Lewy Body Parkinson Disease) OR (Primary Parkinsonism) OR (Parkinsonism, Primary) OR (Paralysis Agitans) in Title Abstract Keyword - (Word variations have been searched)

#2 (Rehabilitation) OR (Habilitation) in Title Abstract Keyword - (Word variations have been searched)

#3 (Virtual Reality) OR (Reality, Virtual) OR (Virtual Reality, Educational) OR (Educational Virtual Realities) OR (Educational Virtual Reality) OR (Reality, Educational Virtual) OR (Virtual Realities, Educational) OR (Virtual Reality, Instructional) OR (Instructional Virtual Realities) OR (Instructional Virtual Reality) OR (Realities, Instructional Virtual) OR (Reality, Instructional Virtual) OR (Virtual Realities, Instructional) in Title Abstract Keyword - (Word variations have been searched)

#4 #1 AND #2 AND #3 99 (Search results)

(2) MS (Multiple sclerosis):

#1 (Multiple sclerosis) OR (Sclerosis, Multiple) OR (MS (Multiple Sclerosis)) OR (Sclerosis, Disseminated) OR (Disseminated Sclerosis) OR (Multiple Sclerosis, Acute Fulminating) in Title Abstract Keyword - (Word variations have been searched)

#2 (Rehabilitation) OR (Habilitation) in Title Abstract Keyword - (Word variations have been searched)

#3 (Virtual Reality) OR (Reality, Virtual) OR (Virtual Reality, Educational) OR (Educational Virtual Realities) OR (Educational Virtual Reality) OR (Reality, Educational Virtual) OR (Virtual Realities, Educational) OR (Virtual Reality, Instructional) OR (Instructional Virtual Realities) OR (Instructional Virtual Reality) OR (Realities, Instructional Virtual) OR (Reality, Instructional Virtual) OR (Virtual Realities, Instructional) in Title Abstract Keyword - (Word variations have been searched)

#4 #1 AND #2 AND #3 79(Search results)

(3) CI (Cognitive Dysfunction):

- #1 (Cognitive Dysfunction) OR (Cognitive Dysfunctions) OR (Dysfunction, Cognitive) OR (Dysfunctions, Cognitive) OR (Cognitive Disorder) OR (Cognitive Disorders) OR (Disorder, Cognitive) OR (Disorders, Cognitive) OR (Cognitive Impairments) OR (Cognitive Impairment) OR (Impairment, Cognitive) OR (Impairments, Cognitive) OR (Mild Cognitive Impairment) OR (Cognitive Impairment, Mild) OR (Cognitive Impairments, Mild) OR (Impairment, Mild Cognitive) OR (Impairments, Mild Cognitive) OR (Mild Cognitive Impairments) OR (Cognitive Decline) OR (Cognitive Declines) OR (Decline, Cognitive) OR (Declines, Cognitive) OR (Mental Deterioration) OR (Deterioration, Mental) OR (Deteriorations, Mental) OR (Mental Deteriorations) in Title Abstract Keyword - (Word variations have been searched)
- #2 (Rehabilitation) OR (Habilitation) in Title Abstract Keyword - (Word variations have been searched)
- #3 (Virtual Reality) OR (Reality, Virtual) OR (Virtual Reality, Educational) OR (Educational Virtual Realities) OR (Educational Virtual Reality) OR (Reality, Educational Virtual) OR (Virtual Realities, Educational) OR (Virtual Reality, Instructional) OR (Instructional Virtual Realities) OR (Instructional Virtual Reality) OR (Realities, Instructional Virtual) OR (Reality, Instructional Virtual) OR (Virtual Realities, Instructional) in Title Abstract Keyword - (Word variations have been searched)
- #4 #1 AND #2 AND #3 296 (Search results)

3. Search strategy for Web of Science

(1) PD (Parkinson Disease):

- #1 (Parkinson Disease) OR (Idiopathic Parkinson's Disease) OR (Lewy Body Parkinson's Disease) OR (Parkinson's Disease, Idiopathic) OR (Parkinson's Disease, Lewy Body) OR (Parkinson Disease, Idiopathic) OR (Parkinson's Disease) OR (Idiopathic Parkinson Disease) OR (Lewy Body Parkinson Disease) OR (Primary Parkinsonism) OR (Parkinsonism, Primary) OR (Paralysis Agitans) (Topic)
- #2 (Rehabilitation) OR (Habilitation) (Topic)
- #3 (Virtual Reality) OR (Reality, Virtual) OR (Virtual Reality, Educational) OR (Educational Virtual Realities) OR (Educational Virtual Reality) OR (Reality, Educational Virtual) OR (Virtual Realities, Educational) OR (Virtual Reality, Instructional) OR (Instructional Virtual Realities) OR (Instructional Virtual Reality)

OR (Realities, Instructional Virtual) OR (Reality, Instructional Virtual) OR (Virtual Realities, Instructional) (Topic)

#4 #1 AND #2 AND #3 213 (Search results)

(2) MS (Multiple sclerosis):

#1 (Multiple sclerosis) OR (Sclerosis, Multiple) OR (MS (Multiple Sclerosis)) OR. (Sclerosis, Disseminated) OR (Disseminated Sclerosis) OR (Multiple Sclerosis, Acute Fulminating) (Topic)

#2 (Rehabilitation) OR (Habilitation) (Topic)

#3 (Virtual Reality) OR (Reality, Virtual) OR (Virtual Reality, Educational) OR. (Educational Virtual Realities) OR (Educational Virtual Reality) OR (Reality, Educational Virtual) OR (Virtual Realities, Educational) OR (Virtual Reality, Instructional) OR (Instructional Virtual Realities) OR (Instructional Virtual Reality) OR (Realities, Instructional Virtual) OR (Reality, Instructional Virtual) OR (Virtual Realities, Instructional) (Topic)

#4 #1 AND #2 AND #3 189 (Search results)

(3) CI (Cognitive Dysfunction):

#1 (Cognitive Dysfunction) OR (Cognitive Dysfunctions) OR (Dysfunction, Cognitive) OR (Dysfunctions, Cognitive) OR (Cognitive Disorder) OR (Cognitive Disorders) OR (Disorder, Cognitive) OR (Disorders, Cognitive) OR (Cognitive Impairments) OR (Cognitive Impairment) OR (Impairment, Cognitive) OR (Impairments, Cognitive) OR (Mild Cognitive Impairment) OR (Cognitive Impairment, Mild) OR (Cognitive Impairments, Mild) OR (Impairment, Mild Cognitive) OR (Impairments, Mild Cognitive) OR (Mild Cognitive Impairments) OR (Cognitive Decline) OR (Cognitive Declines) OR (Decline, Cognitive) OR (Declines, Cognitive) OR (Mental Deterioration) OR (Deterioration, Mental) OR (Deteriorations, Mental) OR (Mental Deteriorations) (Topic)

#2 (Rehabilitation) OR (Habilitation) (Topic)

#3 (Virtual Reality) OR (Reality, Virtual) OR (Virtual Reality, Educational) OR. (Educational Virtual Realities) OR (Educational Virtual Reality) OR (Reality, Educational Virtual) OR (Virtual Realities, Educational) OR (Virtual Reality, Instructional) OR (Instructional Virtual Realities) OR (Instructional Virtual Reality) OR (Realities, Instructional Virtual) OR (Reality, Instructional Virtual) OR (Virtual

Realities, Instructional) (Topic)

#4 #1 AND #2 AND #3 539 (Search results)

Table S1. Quality evaluation of randomized controlled trials using the PEDro scale.

Article, Year	Eligibil ity criteria	Random allocatio n	Concealed allocation	Baseline similarity	Subject blinding	Therapist blinding	Assessor blinding	> 85% follow up	Intention- to-treat analysis	Between- group statistical compariso n	Point and variabil ity measur es	Total (0-11 Scale)	Quality
Feng et al., 2019	Yes	Yes	CA	No	No	No	Yes	Yes	No	Yes	Yes	6	Moderate
Goffredo et al., 2023	Yes	Yes	Yes	Yes	CA	Yes	Yes	Yes	No	Yes	Yes	9	High
Kashif et al., 2024	Yes	Yes	CA	Yes	No	No	Yes	Yes	Yes	Yes	Yes	8	High
Lee et al., 2015	Yes	Yes	CA	Yes	No	No	No	Yes	No	Yes	Yes	6	Moderate
Yang et al., 2016	Yes	Yes	CA	Yes	No	No	Yes	Yes	Yes	Yes	Yes	8	High
Gandolfi et al., 2017	Yes	Yes	CA	Yes	No	No	Yes	Yes	No	Yes	Yes	9	High
Liao et al., 2015	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	8	High
Maranesi et al.,	Yes	Yes	CA	Yes	No	No	Yes	Yes	No	Yes	Yes	7	High

2022

Mirelm
an et
al.,
2016
Park et
al.,
2020
Hsieh
et al.,
2018
Choi et
al.,
2019
Liao et
al.,
2019
Kim et
al.,
2023
Park et
al.,
2022
LIAO
et al.,
2020
Baldim
tsi et
al.,
2023

Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	9	High
Yes	Yes	Yes	Yes	CA	CA	CA	Yes	No	Yes	Yes	7	High
Yes	No	CA	Yes	No	No	No	Yes	Yes	Yes	Yes	6	Moderate
Yes	Yes	CA	Yes	CA	CA	Yes	Yes	Yes	Yes	Yes	8	High
Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	8	High
Yes	Yes	CA	Yes	CA	CA	CA	Yes	No	Yes	Yes	6	Moderate
Yes	Yes	CA	Yes	No	No	Yes	Yes	No	Yes	Yes	7	High
Yes	Yes	CA	Yes	No	No	Yes	Yes	No	Yes	Yes	7	High
Yes	Yes	Yes	CA	CA	No	CA	Yes	No	Yes	Yes	6	Moderate

Gutiérrez et al., 2013	Yes	Yes	CA	Yes	CA	CA	Yes	Yes	No	Yes	Yes	7	High
Gutiérrez et al., 2013	Yes	Yes	CA	Yes	No	No	CA	Yes	No	Yes	Yes	6	Moderate
Lozano-Quilis et al., 2014	Yes	Yes	CA	Yes	Yes	No	No	Yes	No	Yes	Yes	7	High
Kalron et al., 2016	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	8	High
Peruzzi et al., 2016	Yes	Yes	CA	Yes	No	No	Yes	No	No	Yes	Yes	6	Moderate
Marcos-Antón et al., 2023	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	10	High
Waliño - Paniagua et al., 2019	Yes	Yes	CA	Yes	No	No	Yes	No	No	Yes	Yes	6	Moderate
Cuesta - Gómez et al., 2020	Yes	Yes	CA	Yes	No	No	Yes	Yes	No	Yes	Yes	7	High

Goffredo et al., 2023	Yes	Yes	CA	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	9	High
Leonardi et al., 2021	Yes	Yes	CA	Yes	CA	CA	CA	Yes	Yes	Yes	Yes	7	High
Maggiolo et al., 2023	Yes	Yes	CA	Yes	CA	Yes	Yes	Yes	Yes	Yes	Yes	9	High
Pagliarini et al., 2021	Yes	Yes	CA	Yes	CA	Yes	Yes	Yes	Yes	Yes	Yes	9	High
Maggiolo et al., 2022	Yes	Yes	CA	Yes	CA	Yes	Yes	Yes	Yes	Yes	Yes	9	High
Doğan et al., 2023	Yes	Yes	CA	Yes	No	No	Yes	Yes	No	Yes	Yes	7	High

Note : CA, cannot answer.

Table S2. Quality evaluation of systematic reviews and meta-analyses using the Assessment of Multiple Systematic Reviews Tool.

Article, Year	Priori design	Duplicate study selection and data extraction	Comprehensive literature search	Search for grey literature	List of studies included and excluded provided	Characteristics of included studies provided	Scientific quality assessed	Scientific quality used to formulate conclusions	Methods to combine study findings appropriate	Publication bias assessed	Conflict of interest	Total (0-11 Scale)	Quality
Chen et al., 2020	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	9	High
Kwon et al., 2023	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10	High
Wang et al., 2021	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10	High
Wu et al., 2022	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10	High
Lina et al., 2020	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	8	High
Wang et al., 2019	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	10	High
Sarasso et al., 2021	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11	High
Dockx, et al., 2016	Yes	Yes	Yes	CA	Yes	Yes	Yes	Yes	Yes	No	Yes	9	High

Papaioannou et al., 2022	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10	High
Hill et al., 2016	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11	High
Zuschnegg et al., 2023	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11	High
Wu et al., 2020	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10	High
Kim et al., 2022	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10	High
Yu et al., 2023	Yes	Yes	Yes	CA	Yes	Yes	Yes	Yes	Yes	No	Yes	9	High
Son et al., 2022	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10	High
Zhong et al., 2020	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10	High
Yan et al., 2022	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11	High
Ren et al., 2024	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10	High

MURA et al., 2017	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11	High
Gómez - Cáceres et al., 2022	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	9	High
Castellano- Aguilera et al., 2022	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11	High
Casuso - Holgado et al., 2018	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	9	High
Keersmaeck er et al., 2019	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	9	High
Nascimento et al., 2021	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	10	High
Cortés- Pérez et al., 2023	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11	High

Calafio re et al., 2021	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10	High
Zhang et al., 2024	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11	High
Dohert y et al., 2024	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	9	High

Note : CA, cannot answer.

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Page 1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Page 2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Pages 3 to 4
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 5
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Pages 17 to 18
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Pages 17 to 18
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Pages 17 to 18
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Pages 18
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Pages 18 to 19
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	NA
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Page 18
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Pages 18 to 19
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Pages 18 to 19
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Page 6
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Page 6
Study characteristics	17	Cite each included study and present its characteristics.	Page 6
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Pages 11 to 12
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Pages 6 to 11
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Pages 6 to 11
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Pages 6 to 11
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Pages 6 to 12
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	NA
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Pages 11 to 12
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Pages 7 to 12
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Pages 12 to 13
	23b	Discuss any limitations of the evidence included in the review.	Pages 15 to 16
	23c	Discuss any limitations of the review processes used.	Pages 15 to 16
	23d	Discuss implications of the results for practice, policy, and future research.	Pages 15 to 16
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	NA
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	NA
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	NA

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Page 19
Competing interests	26	Declare any competing interests of review authors.	Page 19
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	NA

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